

Supplementary material for the manuscript "Effect of small-scale snow surface roughness on snow albedo and reflectance" by Terhikki Manninen, Kati Anttila, Emmihenna Jääskeläinen, Aku Riihelä, Jouni Peltoniemi, Petri Räisänen, Panu Lahtinen, Niilo Siljamo, Laura Thölix, Outi Meinander, Anna Kontu, Hanne Suokanerva, Roberta Pirazzini, Juha Suomalainen, Teemu Hakala, Sanna Kaasalainen, Harri Kaartinen, Antero Kukko, Olivier Hautecoeur and Jean-Louis Roujean

The figures are related to the text starting in line 376:

The relationship between other surface roughness parameters (such as rms height σ and correlation length L) and β is in general not strong even for a Gaussian surface height distribution (Beckmann & Spizzichino, 1963). For the whole period (March 3 – April 28, 2009) the ratio of σ/L (determined for 0.60 m distance) correlated however relatively well with β , the R^2 values being 0.70 (**Figure. S1**), 0.62 and 0.67 for the whole data range, March and April, respectively, but the best descriptor of β was found to be σ/b (Eq. 1, **Figure. S2**), its R^2 values for the linear correlation being 0.78, 0.68 and 0.82 for the whole data range, March and April, respectively. β tends to increase with the progress of the melting season (0.002 radians per day). Likewise, its correlation with σ/b increases during the melting season. It was therefore examined, whether the measured surface albedo correlates well with the measured surface roughness parameters. Using just the rms height (derived for a 0.60 m horizontal scale) as an explanatory variable of the albedo the coefficient of determination was $R^2 = 0.81$ (**Figure. S3**). The relationship between the albedo and surface roughness parameters that are scale-independent in a large range (Manninen, 2003) was then evaluated. Indeed, a simple linear regression for the data of March and April, 2009 produced a coefficient of determination value as high as $R^2 = 0.90$, when the parameters b and k_0 (see Eqs. 1 and 2) were used as explanatory variables (Figure 8). While correlation is not a proof of causality, this result supports the view that surface roughness affects the albedo.

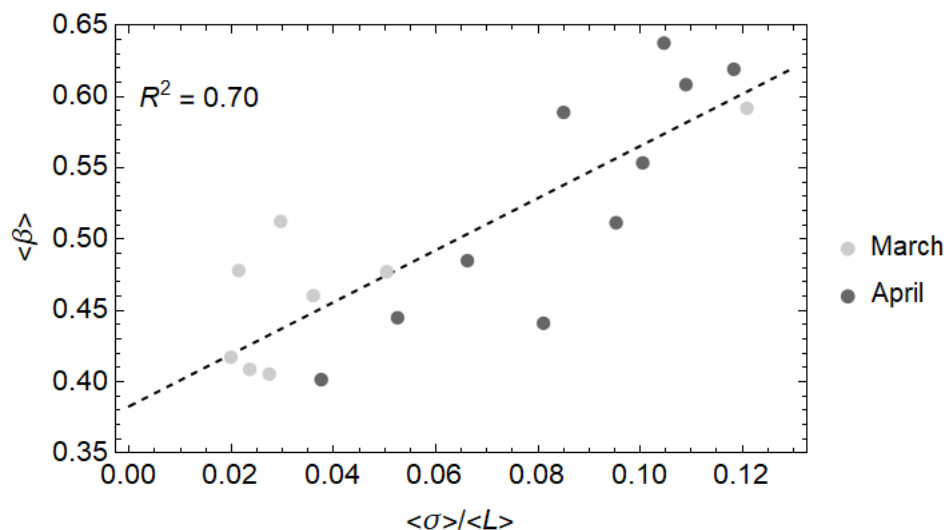


Figure S1. Rms slope (in radians) vs. the ratio of the average daily rms height and the average daily correlation length in March and in April.

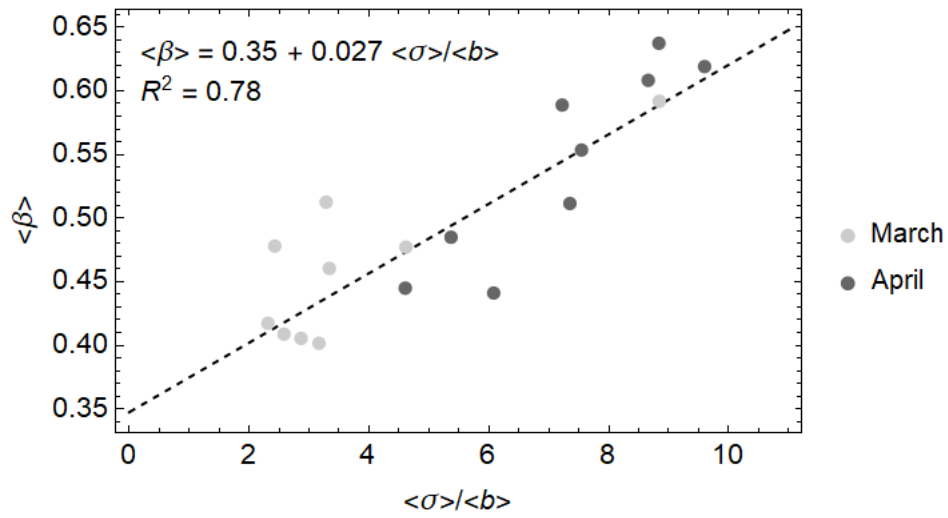


Figure S2. Rms slope (in radians) vs. the ratio of the average daily rms height and the average daily roughness parameter b of Eq.1 in March and in April.

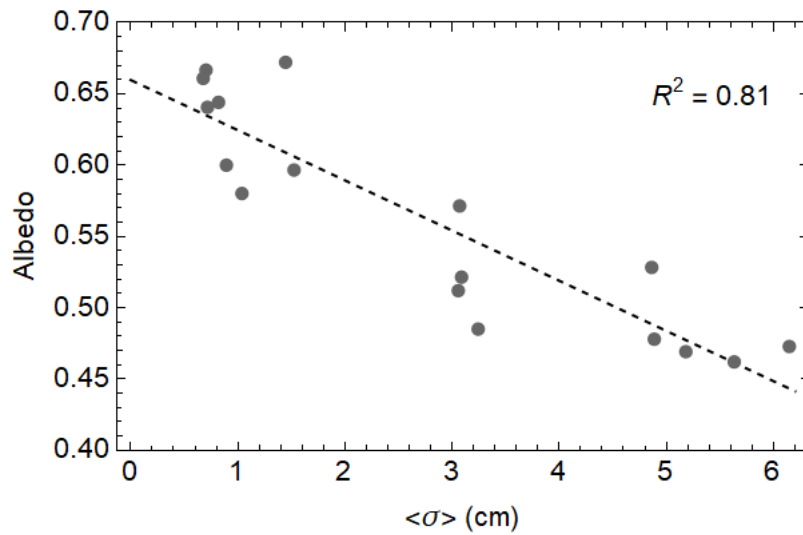


Figure S3. Albedo as a function of the daily average rms height.